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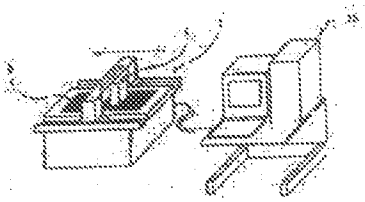
(54) PRINTED WIRING BOARD AND MANUFACTURE THEREOF

(57)Abstract:
PROBLEM TO BE SOLVED: To enable manufacturing with cost reduction, without need for long time using a simple manufacturing method, by simultaneously forming a conductor pattern on the surface of an insulator.
SOLUTION: An ink-jet unit 7 connected with a personal computer 10 has an ink-jet nozzle 8 which can be slid sideways and longitudinally, and an insulator 9 is placed on a carrier which can carry the insulator 9 in the direction of travel, and both of a conductor pattern and an insulating pattern are formed simultaneously on the surface of the insulator 9 by a jet of ink from a nozzle on the basis of pictorial information data transmitted by the personal computer. When ink to be used is solvent type or heat curing type, the insulator 9 is carried through a heating furnace subsequent to the ink-jet unit 7 for drying solvent or cure binder. This allows manufacturing time to be shorten by simple equipment and method.



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CLAIMS

[Claim(s)]
[Claim 1] The manufacture approach of the printed wired board characterized by forming a conductor pattern and an insulating pattern simultaneously on the surface of an insulator.
[Claim 2] The manufacture approach of the printed wired board characterized by forming the conductor pattern and insulating pattern in claim 1 by the ink jet method.
[Claim 3] The manufacture approach of the printed wired board characterized by inputting into a computer and carrying out pattern formation to this graphic form information by ****** and the ink jet method in the manufacture approach of the printed wired board in claims 1 or 2 by making a conductor pattern and an insulating pattern into graphic form information.
[Claim 4] The manufacture approach of the printed wired board characterized by the thickness of claim 1 or the conductor pattern in 2 or 3, and an insulating pattern being equal thickness.
[Claim 5] The manufacture approach of the printed wired board characterized by forming a multilayer circuit by repeating formation of the conductor pattern in claim 1, and an insulating pattern.
[Claim 6] The manufacture approach of a printed wired board that between the circuits of the multilayer circuit in claim 5 is characterized by having flowed electrically.
[Claim 7] The printed wired board manufactured by the manufacture approach of claims 1-6.
[Claim 8] The printed wired board to which an insulator is characterized by being the insulation sheet which has flexibility in the printed wired board in claim 7.
[Claim 9] The printed wired board to which an insulator is characterized by being the printed-circuit board which has rigidity in the printed wired board in claim 7.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the manufacture approach of a printed wired board with

easy formation of a conductor pattern especially about the manufacture approach of the printed wired board used for electronic equipment, an electrical machinery and apparatus, a computer, communication equipment, etc.

[0002]

[Description of the Prior Art] Semi-conductors, various electronic parts, etc., such as LSI, are mounted in electronic equipment, communication equipment, a computer, etc., and the printed wired board is used for them. The thing using the composite of reinforcing materials who a printed wired board has many classes and use a ceramic as a base material, such as a thing and a glass fiber, and synthetic resin, such as an epoxy resin, There are some which use flexible films, such as polyester resin and aramid resin, as a base material., in view of the number of circuitry layers The circuitry layer on the same field as the thing of a monolayer is divided into two or more multilayer boards etc., and the circuitry layer on the same field of a double-sided plate, a piece face-plate, etc. is properly used according to an application or demand characteristics, respectively. these printed wired boards --- each --- a conductor --- it has the circuit and densification of the circuit pattern is carried out by the miniaturization of a device, or high performance-ization of a semi-conductor.

[0003] Generally circuit pattern formation of a printed wired board is performed by the subtractive process. That the circuit formation by the subtractive process has many routing counters although the patterning process by the perforation process, the electroless deposition process, a dry film, etc. and electrolysis galvanizer are formed through an etching process, a solder exfoliation process, etc., when taking the time amount which each process takes, the rate of the conversion cost occupied to a manufacturing cost is high, and reduction of this conversion cost has been the big technical problem of the printed wired board industry. Especially, in the case of a multilayer-interconnection plate, this can say. Moreover, it also has problems, such as waste fluid processing generated in a plating process or an etching process. In order to solve these problems, various proposals have accomplished. For example, in JP,8-244138,A, shortening of a pattern formation process is measured by using the Mitsuzo form method. Moreover, in JP,8-316639,A or JP,9-8458,A, the manufacture approach of the multilayer printed wiring board by the so-called build up method is indicated. However, when based on the Mitsuzo mold method, it is difficult to put reinforcing materials, such as a glass fiber, into a substrate, a problem is in the dimensional stability of a substrate in a plating process or a pattern formation process, and an application is limited. Moreover, although a part of laminating processes, such as prepreg material, can be skipped when based on the latter build up method, the perforation process, the plating process, the dry film process, the etching process, etc. are required, and have not led to such process shortening.

[0004]

[Problem(s) to be Solved by the Invention] many problems, like this invention requires the complexity of the formation process of the circuit pattern in manufacture of a printed wired board, the numerousness of routing counters, and long duration --- solving --- the easy manufacture approach --- and processing cost is aimed cheap at offer of the manufacture approach of a ****** printed wired board. Moreover, it aims at offer of the manufacture approach of the printed wired board which neither harmful plating waste fluid nor etching waste fluid generates.

[0005]

[Means for Solving the Problem] This invention is accomplished in order to attain the above-mentioned object, and claim 1 of this invention is the manufacture approach of the printed wired board characterized by forming a conductor pattern and an insulating pattern simultaneously on the surface of an insulator, and is characterized by claim 2 forming said conductor pattern and an insulating pattern by the ink jet method. Moreover, in the manufacture approach of the printed wired board of claim 3, by making a conductor pattern and an insulating pattern into graphic form information, it inputs into a computer and is characterized by carrying out pattern formation to this graphic form information by ****** and the ink jet method. Furthermore, it is the manufacture approach of the printed wired board characterized by forming a multilayer circuit by being characterized by making thickness of a conductor

pattern and an insulating pattern into equal thickness by the manufacture approach of claim 4, and repeating formation of the conductor pattern described above in claim 5, and an insulating pattern. Moreover, between the circuits of the multilayer circuit obtained by claim 6 in claim 8 is the manufacture approach of the printed wired board characterized by having flowed electrically. Claim 7 of this invention finds out that solution of said technical problem is possible, when it is the printed wired board manufactured by the manufacture approach of claims 1-6, claim 8 is characterized by the insulator in this printed wired board being the insulation sheet which has flexibility and claim 9 considers as the printed wired board characterized by being the printed-circuit board with which the insulator in the printed wired board in claim 7 has rigidity.

[0006]

[Embodiment of the Invention] The semantics of the language of the conductor pattern used in this invention and an insulating pattern is explained. A conductor pattern points out the thing of the circuit pattern formed on the surface of the printed wired board, it is obtained by usually etching copper foil, and thickness is about 5-35 micrometers. On the other hand, an insulating pattern points out the other part except a circuit pattern in the circuit side of a printed wired board, and the thickness is almost the same as the thickness of a conductor pattern. Therefore, the circuit side of the printed wired board manufactured by the manufacture approach of the printed wired board of this invention is formed from the circuit pattern and the insulating pattern. In the manufacture aproach of the printed wired board of this invention, it is the big description to form a conductor pattern and the other insulating pattern simultaneously. Not both the patterns formed simultaneously crossed, or did not lap selectively, and have touched by the same thickness on the boundary. Although especially the approach of forming simultaneously two kinds of different patterns on the same side is not limited, it is suitable for it to use the ink jet method well used for the printer of a personal computer etc. recently.

[0007] There is a method of various types in an ink jet printer with the injection method of ink. For example, there are a piezoelectric-device mold, a bubble jet mold, an airstream mold, a solid thermofusion nature ink mold, an electrostatic-induction mold, a sound ink print mold, an electric viscosity ink mold, a continuation injection mold suitable for mass production method, etc. Either of said method can be used for the ink jet method used for this invention, and it can be suitably chosen according to the configuration of a pattern, the class of thickness and ink, etc. In the case of an ink jet method, since resolution can be set up in the range of 200 ~ 1000dpi by adjusting the magnitude of the ink particle to inject, thinning of pattern width of face or the pitch can be carried out by about 100 micrometers. Therefore, it can respond also to the demand to the densification of a circuit pattern enough. Moreover, a pattern can be formed on an insulator using the graphic form information inputted into the computer by connecting computers, such as a personal computer, with an ink jet printer. by inputting graphic form information into a computer, form a conductor pattern and an insulating pattern simultaneously at 1 time of a process, and pass many conventional processes -- as compared with the circuit forming method for having required the long time, it can be markedly alike, and pattern formation can be performed easily in a short time. Neither a screen printer nor the facility for etching also in facility is needed, but the pattern formation equipment of the ink jet method interlocked with a computer and an easy dryer can make it what is necessary be just to be in facility and cheaply.

[0008] Furthermore, since there is also no generating of plating waste fluid, etching waste fluid, etc., processing, a processing facility, etc. of these waste fluid are unnecessary. As for the conductor pattern and insulating pattern in this invention which are formed simultaneously, it is desirable for thickness to be almost equal, and, in the case of the printed wired board which has especially a multilayer circuit, it is desirable for the thickness of both the patterns in a inner layer circuit to be the same. Conductive ink performs the ingredient for forming the conductor pattern in this invention. As conductive ink, phenol resin and an epoxy resin are made to distribute conductive ingredients, such as copper powder and silver dust, and what mixed the solvent, the curing agent, the dispersant, the antioxidant, etc. is used. Moreover, the heat-curing mold solder resist to which the ingredient for forming an insulating pattern

uses an epoxy resin as a principal component is used. When solvent type ink is used as ink, a solvent is evaporated by pattern formation afterbaking desiccation. Furthermore, continuously, in the case of hardening type ink, heat hardening is performed, and it achieves fixing unification to an insulator or a lower layer pattern.

[0009] Since it has flat-surface configurations, such as the shapes of the shape of a film, and a sheet, and tabular, and the thing of the shape of the shape of a film or a sheet can form a patterned layer continuously especially, the insulator used for this invention is geometrically desirable. Moreover, even if it is not a flat surface, a curved surface is sufficient as long as an ink jet is possible. What textiles and the nonwoven fabric by polyester film, an aromatic polyamide film and a thermoplastics film like a polyimide film and a glass fiber and polyester fiber, and aromatic polyamide fiber were made to carry out impregnation hardening of thermoplastics or the epoxy resin, and was made into the shape of a sheet in construction material, and a tabular thing like the glass epoxy laminate used for the further usual printed wired board can be raised. According to the manufacture approach of this invention, if simultaneous formation of a conductor pattern and an insulating pattern is repeated, a multilayer printed wiring board can be manufactured, and in a multilayer printed wiring board, the printed wired board which has the same effectiveness as a through hole patchboard can be manufactured by forming in an interlayer the conductor pattern which makes it flow through between the upper conductor pattern and a lower layer conductor pattern. The patchboard which has the same effectiveness as a through hole multilayer-interconnection plate can be obtained easily, without performing a drilling process and a through hole plating process.

[0010]

[Example] As an example, the example of manufacture of the printed wired board which has the pad circuit for chip resistors of a three-layer pattern is shown. The polyimide film with a thickness of 100 micrometers was used as an insulator. The solder resist of an epoxy resin system was used as ink for insulating patterns using the ink which used copper powder as a conductor and used the heat-curing type epoxy resin as a binder as conductive ink. As ink jet equipment which forms a conductor pattern and an insulating pattern simultaneously on an insulator, the thing of Bubble Jet was used and it was based on the equipment of a configuration as shown in drawing 5 . the graphic form information data which the ink jet equipment 7 connected to the personal computer 10 has the ink jet nozzle 8 which can be slid to the cross direction and a longitudinal direction, and installation immobilization was carried out on the base material which can convey an insulator 9 to a travelling direction, and were sent from the personal computer -- a basis -- both a conductor pattern and an insulating pattern are simultaneously formed in the front face of an insulator 9 in the ink injected from a **** nozzle. Solvent desiccation and binder hardening are performed by the ink used following ink jet equipment in the case of a solvent type and heat-curing type, and letting a heating furnace (not shown in drawing 5) pass. In the case of quick-drying ink, pattern formation by the ink jet can be performed continuously.

[0011] Next, drawing explains the pattern formation of a printed wired board. Drawing 1 (a) 1 shows pattern drawing of the 1st layer formed on the polyimide film. Drawing 1 (b) is drawing 1 (a). The sectional view of AA'line part which can be set is shown. (a) 1a which can be boiled and set shows a conductor pattern, and width of face is 150 micrometers. 1b shows an insulating pattern and is 1. Parts other than the conductor pattern which can be set are insulating patterns. (b) In ********, conductor pattern 1a and insulating pattern 1b touching a boundary on a polyimide film 6, and being formed by the same thickness is shown. In the case of this example, the thickness of a pattern made it 25 micrometers. A solvent is dried at 100-130 degrees C all over a heating furnace, and, as for the film with which the pattern was formed, hardening of a binder is performed. Drawing 2 R> 2 and drawing 3 show the two-layer eye, pattern drawing, and the sectional view of the 3rd layer similarly, respectively. Drawing 2 (a) The circuit pattern for a flow is shown, 2a shows a conductor pattern and 2b shows an insulating pattern. drawing 2 R> 2 (b) (a) BB' -- the conductor pattern 1a top which is a sectional view for a line part, and pattern 2a of a two-layer eye and 2b are formed on the patterns 1a and 1b of the 1st layer.

and is in AA'line of the 1st layer especially — BB' of a two-layer eye — it is formed so that conductor pattern 2a on a line may lap.

[0012] (a) of drawing 3 It is a circuit pattern, and 3a is a conductor pattern and 3b is an insulating pattern. (b) ** (a) The sectional view in CC'line is shown. from this sectional view, the patterns 3a and 3b of the 3rd layer form on pattern 2a of a two-layer eye, and 2b — having — **** — especially — BB' of a two-layer eye — the upper conductor pattern 2a top — CC' of the 3rd layer — a part of conductor pattern 3a which is upwards has lapped. AA' in drawing 1 , drawing 2 , and drawing 3 , BB', and CC' show the same location, therefore drawing 1 and each sectional view in 2 and 3 show the place where sequential formation of the pattern of the 1st layer, the pattern of a two-layer eye, and the pattern of the 3rd layer is carried out on a polyimide film in the same location. drawing 3 (b) the conductor of 1a and 3a — a circuit — the conductor of 2a — it turns out that it has flowed by the circuit. the conductor of the 3rd layer — a circuit — CC' — the place of an except — the conductor of the 1st layer — it has flowed by the circuit and the circuit of a two-layer eye. (a) of drawing 4 what is depended only on an insulating pattern — it is — a conductor — protection and the chip of a circuit, and a conductor — it is what made it the key objective to prepare the pad path clearance for making connection with a circuit, and differs from a pattern which forms simultaneously a conductor pattern like drawing 1 -3, and an insulating pattern. Therefore, it can carry out with the screen printing of the conventional technique etc., and can form also by the approach of this invention.

[0013] Drawing 4 (a) It sets, 4b shows an insulating pattern, 4c shows pad path clearance, and ink is not injected by this part. Usually, it considers as the printed wired board for chip resistors in this condition. Drawing 4 (b) It is drawing in which the fluoroscopy section of the conductor pattern of one layer - three layers currently formed in the bottom of the insulation pattern of the 4th layer was shown by the dotted line. In the part of pad path clearance 4c, the circuit of the 3rd layer is exposure ****** to a front face. (b) the sectional view of a ** DD'part — (c) it is . The insulation protective layer of the 4th layer is formed on the three-layer pattern. The circuit of the 3rd layer has come out to the front face in the part of the pad path clearance of 4c, and it connects with the terminal of a chip resistor with solder in this part. The multilayer printed wiring board for chip resistors through which had the three-layer circuit by the approach of this invention above, and between three-layer circuits has flowed was able to be manufactured easily.

[0014]

[Effect of the Invention] The equipment and the approach with easy manufacture of the printed wired board which required the conventional complicated process and circuit formation had taken time amount by the manufacture approach of the printed wired board of this invention enabled it to manufacture far for a short time. Moreover, according to the manufacture approach of this invention, there is neither etching nor generating of the waste fluid in a plating process, and an activity or a facility required for these waste fluid processing are not needed, either, but the merit as the manufacture approach is large. Moreover, the printed wired board by this invention can make processing cost cheap, and further, circuit width of face and a pitch can be made small, and it has the merit that multilayering is also easy.

[Translation done.]

2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The conductor pattern of the 1st layer, the example of an insulating pattern, and its sectional view are shown.
[Drawing 2] The conductor pattern of a two-layer eye, the example of an insulating pattern, and its sectional view are shown.
[Drawing 3] The conductor pattern of the 3rd layer, the example of an insulating pattern, and its sectional view are shown.
[Drawing 4] the example of the insulation pattern of the 4th layer, and a conductor — the perspective drawing and the sectional view of a circuit
[Drawing 5] The example of ink jet equipment used for the manufacture approach of this invention
[Description of Notations]
1. Example of Pattern of the 1st Layer
1a.1 layer conductor pattern
An insulating 1b.1 layer pattern
2. Example of Pattern of Two-layer Eye
The conductor pattern of a 2a. two-layer eye
The insulating pattern of a 2b. two-layer eye
3. Example of Pattern of the 3rd Layer
3a.3 layer conductor pattern
An insulating 3b.3 layer pattern
4. Example of Pattern of the 4th Layer
An insulating 4b.4 layer pattern
4c. Pad path clearance
5. Perspective Drawing of Conductor Pattern
5a. The fluoroscopy section of a conductor pattern
5b. Insulating pattern section
6. Insulator
7. Ink Jet Equipment
8. Ink Jet Nozzle
9. Computer (Personal Computer)

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